DEPARTMENT OF HEALTH & HUMAN SERVICES

Program Support Center

Federal Occupational Health Service
1301 Young Street, Suite 772
Dallas, Texas 75202

October 23, 2014

Ms. Cassie Watson
Chief, Operations Branch
US EPA/Safety, Health & Environmental Mgmt. Division
Ronald Reagan Building M305B
Washington, DC 20460

Re: Indoor Air Quality Survey – EPA – Potomac Yard facility

Dear Ms. Watson:

On October 1, 2014, Federal Occupational Health representative Kim Fowler conducted an indoor air quality survey in the EPA's Potomac Yard facility, 2733 Crystal Drive, Arlington, Virginia. The survey was requested in response to an employee's reported diagnosis of a fungal lung infection.

EVALUATION METHODS

The scope of the work included bioaerosol and spore sampling, and carbon dioxide, temperature, and relative humidity determinations.

BIOAEROSOLS

Bioaerosol sampling was performed using a SAS Microbial Air Sampler. The sampler draws air through a microsieve plate at a calibrated rate, which accelerates airborne particles thus, impacting them onto tryptic soy agar and malt extract agar filled plates. Once on the agar plates, viable particles can grow into visible colonies. Their numbers give an indication of the airborne concentration of viable fungi and bacteria. During the incubation period (samples were incubated at room temperature, 23±2°C, from October 2 through 10, 2014) subsequent colonies were isolated, identified (genus) and counted to calculate airborne concentrations for each sample location.

SPORE SAMPLING

Spore sampling was performed by drawing air through an Aerotrap Spore Sampler and aimed directly at a sticky and optically clear sampling media (microscope slide). An air-sampling rate of fifteen liters per minute was used. This process accelerates airborne particles, impacting them onto the gel strip inside the sampler. Each sample slide was labeled with an identifiable number and sealed in a slide storage container. All samples were collected for seven minutes at each location. The samples were submitted to Aerobiology Laboratory in Dulles, Virginia for characterization and enumeration.

CARBON DIOXIDE

Carbon dioxide (CO_2) levels were measured using Grey Wolf direct reading indoor air quality instrument. The instrument was two-point calibrated prior to use with a certified zero gas and 1,000 ppm CO_2 span gas. Carbon dioxide was analyzed continuously for approximately ten minutes at each site with average concentrations computed.

TEMPERATURE AND RELATIVE HUMIDITY

Temperature and relative humidity levels were measured using a Grey Wolf direct reading indoor air quality instrument. Temperature and relative humidity were analyzed continuously for approximately ten minutes with averages computed.

CALIBRATION

The sampling rates for the SAS Microbial Air Sampler (180 liters per minute) and the Aerotrap spore sampler (15 liters per minute) were verified with a rotometer prior to sample collection. The Grey Wolf direct reading indoor air quality instrument was calibrated in accordance with manufacturer's procedures. The instrument was two-point calibrated prior to use with a certified zero gas and 1,000 ppm carbon dioxide span gas.

RESULTS AND DISCUSSION

BIOAEROSOLS

Bioaerosols are airborne particles that are living or that are released from living organisms. These living particles have been implicated in human respiratory and skin allergies, hypersensitivity reactions and toxic effects.

Fungal spores and other viable particles may enter a space through the outside air intakes and due to their small size, are not typically eliminated from the air stream by the building air filtration system. Once they have settled out of the air stream, the spores may grow almost anywhere within a building where conditions permit. Optimal conditions include a surface for growth, organic nutrients, darkness, and moisture. Areas in which microorganisms may proliferate or bioamplify include internal surfaces of air handling units and ducts; especially if insulated, ceiling tiles (wet or moist), carpet, and areas, which remain dark, seldom cleaned, or congested with furniture and office materials.

Fungi (molds and yeasts) produce spores during their growth or reproductive cycle. The asexual and/or sexual spores are often considered allergens. It is not known what concentration of spores is required to evoke an allergic reaction. It is known; that individuals exposed intermittently to significantly elevated levels of allergens or moderate levels continuously for a time period (months or years) may become sensitized. An individual sensitized to an allergenic agent is said to have developed an allergy to that agent. Once sensitized, the individual experiences an allergic reaction at each time of exposure. The degree and extent of the reaction is dependent on the exposure concentration, the length of exposure and the individual. Therefore, a sensitized individual may react to relatively low and in some cases undetectable concentrations of allergens while a non-sensitized or less sensitized individual in the same indoor environment will not experience any symptoms.

Airborne fungi naturally occur in most indoor environments. Currently, there are no indoor air quality guidelines or regulations for the determination of measured bioaerosol concentrations. However, excessive numbers or unusual types of microorganisms may cause health problems in sensitive individuals. Interpretation of such sample results depends on professional judgment as to whether types and amounts of organisms are comparable to normal background and the likelihood that the identified organisms will cause allergic reactions or infections. Since spores are only released into the air intermittently, any visible growth, water damage, or excessive dust may be considered an indication of potential bioaerosol problems, even where air-sampling results are negative.

Bioaerosol samples were collected in N-5782 (sample A1) and N-5786 (control – sample A3), as well as outdoors for comparison (sample A5). Bioaerosol results are interpreted by comparing indoor concentrations to outdoor concentrations. The total indoor concentrations should be lower than the total outdoor concentration. In addition, the types of mold found indoors should be similar and their concentrations not significantly higher than those found outdoors. The total indoor fungal concentrations were insignificant and less than the outdoor fungal concentration. The sample locations and detected concentrations, expressed as colony forming units per cubic meter (cfu/m^3) of air, are summarized in Appendix A.

SPORES

Spore samples were collected in N-5782 (sample A2) and N-5786 (control – sample A4), as well as outdoors for comparison (sample A6). Mold spore sample results are interpreted by comparing indoor mold spore concentrations to outdoor mold spore concentrations. The total indoor mold spore concentration should be lower than the outdoor mold spore concentration. In addition, the types of spores found indoors should be similar and their concentrations not significantly higher than those found outdoors. At the time of the sampling, the detected indoor spore concentrations (total) were insignificant and less than the outdoor concentration (total). The sample locations and detected concentrations, expressed as spores per cubic meter ($spores/m^3$) of air, are summarized in Appendix A.

CARBON DIOXIDE

The carbon dioxide data was used to determine the effectiveness of the ventilation system in supplying outside air to the indoor environment. NIOSH indicates that in order to prevent employee discomfort, average carbon dioxide concentrations should not exceed 1000 ppm. ASHRAE recommends not exceeding 700 ppm above the outdoor concentration.

The average carbon dioxide concentration at each sampling location was acceptable. The detected concentrations are summarized in the table below.

Location	**Carbon Dioxide (ppm)**	**Average Temperature (°F)**	**Relative Humidity (%)**
N-5782, office	440	66.5	59.3
N-5786, cubicle (control)	480	66.6	59.6
Outdoors	370	63.9	88.5

TEMPERATURE AND RELATIVE HUMIDITY

The primary functions of a building's ventilation system are to control temperature and humidity and to provide clean outdoor air for the dilution of odors and air contaminants. Many complaints of poor air quality are actually caused or exacerbated by temperature and/or humidity values outside the normal comfort ranges recommended by ASHRAE. These ranges are 73-79°F and 40-60% humidity for summer or 68-74°F and 30-50% humidity for winter.

The average temperatures were below the ASHRAE recommended comfort range. However, the entire suite was vacant so low temperatures would be expected. The relative humidity was within the ASHRAE recommended range.

CONCLUSION/RECOMMENDATIONS

The results for the commonly evaluated indicators of indoor air quality were within acceptable ranges. Sign of moisture damage and mold contamination were not noted in the survey area.

Sincerely,

Kim Fowler, Industrial Hygienist
&
Michael A. Cecil, CIH

Under the direction of:

Mark P Burke

CDR Mark P. Burke, USPHS
Environmental Health Specialist
DHHS/Federal Occupational Health

APENDIX A

BIOAEROSOL & SPORE SAMPLING RESULTS

Aerobiology Laboratory Associates, Incorporated
Expertise Since 1997

43760 Trade Center Place
Suite 100
Sterling, Virginia 20166
(877) 648-9150
www.aerobiology.net

Certificate of Analysis
EMLAP# 102977

M.A. Cecil and Associates
4475 Shannon Way
Port Republic, Maryland 20676
Attn: Mike Cecil
Project: **EPA-Crystal City**
Condition of Sample(s) Upon Receipt: Acceptable

Date Collected: 10/01/2014
Date Received: 10/03/2014
Date Analyzed: 10/09/2014
Date Reported: 10/13/2014
Project ID: 14020907

1054 Spore Trap Analysis: SOP 3.8

Client Sample Number	080114-A2				080114-A6			
Sample Location					Outdoors			
Sample Volume (L)	75				75			
Lab Sample Number	14020907-002				14020907-006			
Spore Identification	Raw Ct	spr/m³	% Ttl	In/Out	Raw Ct	spr/m³	% Ttl	In/Out
ascospores	-	-	-	-	19	8094	19	-
basidiospores	1	13	33	1/2204	69	29393	69	-
Cercospora	-	-	-	-	3	40	<1	-
Cladosporium	1	13	33	1/368	23	4907	11	-
Curvularia	-	-	-	-	1	13	<1	-
hyphal elements	-	-	-	-	3	40	<1	-
Penicillium/Aspergillus group	1	13	33	1/12	12	160	<1	-
Pithomyces	-	-	-	-	2	27	<1	-
Smuts,Periconia,Myxomycetes	-	-	-	-	6	80	<1	-
	Debris Rating **3**				Debris Rating **3**			
Analytical Sensitivity	Analytical Sensitivity: **13** spr/m³				Analytical Sensitivity: **13** spr/m³			
Comments								
Total *See Footnotes	3	40	~100%	1/1069	138	42753	~100%	-

Client Sample Number	080114-A4				080114-A6			
Sample Location					Outdoors			
Sample Volume (L)	75				75			
Lab Sample Number	14020907-004				14020907-006			
Spore Identification	Raw Ct	spr/m³	% Ttl	In/Out	Raw Ct	spr/m³	% Ttl	In/Out
ascospores	-	-	-	-	19	8094	19	-
basidiospores	2	27	25	1/1102	69	29393	69	-
Cercospora	-	-	-	-	3	40	<1	-
Cladosporium	-	-	-	-	23	4907	11	-
Curvularia	-	-	-	-	1	13	<1	-
hyphal elements	-	-	-	-	3	40	<1	-
Penicillium/Aspergillus group	5	67	62	1/2	12	160	<1	-
Pithomyces	-	-	-	-	2	27	<1	-
Smuts,Periconia,Myxomycetes	1	13	12	1/6	6	80	<1	-
	Debris Rating **3**				Debris Rating **3**			
Analytical Sensitivity	Analytical Sensitivity: **13** spr/m³				Analytical Sensitivity: **13** spr/m³			
Comments								
Total *See Footnotes	8	107	~100%	1/401	138	42753	~100%	-

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EMLAP# 102977

M.A. Cecil and Associates
4475 Shannon Way
Port Republic, Maryland 20676
Attn: Mike Cecil
Project: **EPA-Crystal City**
Condition of Sample(s) Upon Receipt: Acceptable

Date Collected: 10/01/2014
Date Received: 10/03/2014
Date Analyzed: 10/09/2014
Date Reported: 10/13/2014
Project ID: 14020907

Client Sample Number	080114-Blank				080114-A6			
Sample Location	Blank				Outdoors			
Sample Volume (L)	0				75			
Lab Sample Number	14020907-008				14020907-006			
Spore Identification	Raw Ct	spr/m³	% Ttl	In/Out	Raw Ct	spr/m³	% Ttl	In/Out
ascospores	-	-	-	-	19	8094	19	-
basidiospores	-	-	-	-	69	29393	69	-
Cercospora	-	-	-	-	3	40	<1	-
Cladosporium	-	-	-	-	23	4907	11	-
Curvularia	-	-	-	-	1	13	<1	-
hyphal elements	-	-	-	-	3	40	<1	-
Penicillium/Aspergillus group	-	-	-	-	12	160	<1	-
Pithomyces	-	-	-	-	2	27	<1	-
Smuts,Periconia,Myxomycetes	-	-	-	-	6	80	<1	-
	Debris Rating **0**				Debris Rating **3**			
Analytical Sensitivity	Analytical Sensitivity: **0** spr/m³				Analytical Sensitivity: **13** spr/m³			
Comments								
Total *See Footnotes	0	0	-	-	138	42753	~100%	-

Client Sample #: 080114-A1
Sample Location: See Field Notes
Test: 1030, Fungal Count w/ Complete Genus ID: SOP 3.2
Positive Hole Corrected Result: **283 cfu/m³**

Lab Sample #: 14020907-001
Positive Hole: **401**
Air Volume: **142 (L)**

Organism(s) Isolated:	Raw Count	cfu/m³	% Total	MRL
Arthrospore-former	1	7	3	7
Cladosporium species	35	246	92	7
Non-sporulating colonies	2	14	5	7
	38	268	~100%	

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M.A. Cecil and Associates
4475 Shannon Way
Port Republic, Maryland 20676
Attn: Mike Cecil
Project: **EPA-Crystal City**
Condition of Sample(s) Upon Receipt: Acceptable

Date Collected: 10/01/2014
Date Received: 10/03/2014
Date Analyzed: 10/09/2014
Date Reported: 10/13/2014
Project ID: 14020907

Client Sample #: 080114-A3
Lab Sample #: 14020907-003
Sample Location:
Test: 1030, Fungal Count w/ Complete Genus ID: SOP 3.2
Positive Hole Corrected Result: **79 cfu/m^3**
Positive Hole: **401**
Air Volume: **142 (L)**

Organism(s) Isolated:	Raw Count	cfu/m^3	% Total	MRL
Arthrospore-former	1	7	9	7
Cladosporium species	4	28	36	7
Non-sporulating colonies	5	35	45	7
Rhodotorula species	1	7	9	7
	11	77	~100%	

Client Sample #: 080114-A5
Lab Sample #: 14020907-005
Sample Location: Outdoors
Test: 1030, Fungal Count w/ Complete Genus ID: SOP 3.2
Positive Hole Corrected Result: **1211 cfu/m^3**
Positive Hole: **401**
Air Volume: **142 (L)**

Organism(s) Isolated:	Raw Count	cfu/m^3	% Total	MRL
Aspergillus niger	1	7	1	7
Cladosporium species	126	887	90	7
Epicoccum species	1	7	1	7
Fusarium species	5	35	4	7
Penicillium species	3	21	2	7
Yeast	4	28	3	7
	140	986	~100%	

Client Sample #: 080114-Blank
Lab Sample #: 14020907-007
Sample Location: Blank
Test: 1030, Fungal Count w/ Complete Genus ID: SOP 3.2
Positive Hole Corrected Result: **No Growth**
Positive Hole: **401**
Air Volume: **0 (L)**

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Certificate of Analysis
EMLAP# 102977

M.A. Cecil and Associates
4475 Shannon Way
Port Republic, Maryland 20676
Attn: Mike Cecil
Project: **EPA-Crystal City**
Condition of Sample(s) Upon Receipt: Acceptable

Date Collected: 10/01/2014
Date Received: 10/03/2014
Date Analyzed: 10/09/2014
Date Reported: 10/13/2014
Project ID: 14020907

Footnotes and Additional Report Information

Debris Rating Table

1	Minimal (<5%) particular present	Reported values are minimally affected by particulate load.
2	5% to 25% of the trace occluded with particulate	Negative bias is expected. The degree of bias increases directly with the percent of the trace that is occluded.
3	26% to 75% of the trace occluded with particulate	Negative bias is expected. The degree of bias increases directly with the percent of the trace that is occluded.
4	75% to 90% of the trace occluded with particulate	Negative bias is expected. The degree of bias increases directly with the percent of the trace that is occluded.
5	Greater than 90% of the trace occluded with particulate	Quantification not possible due to large negative bias. A new sample should be collected at a shorter time interval or other measures taken to reduce particulate load.

1. Penicillium/Aspergillus group spores are characterized by their small size, round to ovoid shape, being unicellular, and usually colorless to lightly pigmented. There are numerous genera of fungi whose spore morphology is similar to that of the Penicillium/Aspergillus type. Two common examples would be Paecilomyces and Acremonium. Although the majority of spores placed in this group are Penicillium, Aspergillus, or a combination of both. Keep in mind that these are not the only two possibilities.

2. Ascospores are sexually produced fungal spores formed within an ascus. An ascus is a sac-like structure designed to discharge the ascospores into the environment, e.g. Ascobolus.

3. Basidiospores are typically blown indoors from outdoors and rarely have an indoor source. However, in certain situations a high basidiospore count indoors may be indicative of a wood decay problem or wet soil.

4. The Smut, Periconia, Myxomycete group is composed of three different groups whose spores have similar morphologies. Smuts are plant pathogens, Periconia is a relatively uncommon mold indoors, and Myxomycetes are not fungi but slime molds. Although these organisms do not typically proliferate indoors, their spores are potentially allergenic.

5. The colorless group contains colorless spores which were unidentifiable to a specific genus. Examples of this group include Acremonium, Aphanocladium, Beauveria, Chrysosporium, Engyodontium microconidia, yeast, some arthrospores, as well as many others.

6. Hyphae are the vegetative mode of fungi. Hyphal elements are fragments of individual Hyphae. They can break apart and become airborne much like spores and are potentially allergenic. A mass of hyphal elements is termed the mycelium. Hyphae in high concentration may be indicative of colonization.

7. Dash (-) in this report, under raw count column means 'not detected (ND)'; otherwise 'not applicable' (NA).

8. The positive-hole correction factor is a statistical tool which calculates a probable count from the raw count, taking into consideration that multiple particles can impact on the same hole; for this reason the sum of the calculated counts may be less than the positive hole corrected total.

9. Due to rounding totals may not equal 100%.

10. Minimum Reporting Limits (MRL) for BULKS, DUSTS, SWABS, and WATER samples are a calculation based on the sample size and the dilution plate on which the organism was counted. Results are a compilation of counts taken from multiple dilutions and multiple medias. This means that every genus of fungi or bacteria recovered can be counted on the plate on which it is best represented.

11. If the final quantitative result is corrected for contamination based on the blank, the blank correction is stated in the sample comments section of the report.

12. Analysis conducted on non-viable spore traps is completed using Indoor Environmental Standards Organization (IESO) Standard 2210.

13. The results in this report are related to this project and these samples only.

14. For samples with an air volume of < 100L, the number of significant figures in the result should be considered (2) two. For samples with air volumes between 100-999L, the number of significant figures in the result should considered (3) three. For example, a sample with a result of 55,443 spr/m3 from a 75L sample using significant figures should be considered 55,000. The same result of 55,443 from a 150L sample using significant figures should be considered 55,400 spr/m^3.

15. If the In/Out ratio is greater than 100 times it is indicated >100/1, rather than showing the real value.

Terminology Used in Direct Exam Reporting

Conidiophores are a type of modified hyphae from which spores are born. When seen on a surface sample in moderate to numerous concentrations they may be indicative of fungal growth.

Suzanne S. Blevins, B.S., SM (ASCP)
Laboratory Director

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14020907

Page 1 of 1

ELITE
CO, GA, VA

NVLAP
NVLAP Lab Code 200860-0
NVLAP Lab Code 200829-0
NVLAP Lab Code 500097-0

AIHA LAP, LLC
LAB #192683 (CO)
LAB #102977 (GA)
LAB #163063 (VA)
LAB #210229 (AZ)

Aerobiology Client	M.A. Cecil and Associates				
Field Contact	Kimberly Fowler	Collected By/Date: 8/1/14		Relinquished By/Date: 8/2/14	
Address	4475 Shannon Way	Relinquished By/Date:		Received By/Date: AM 10/3/14	
Address	Port Republic, MD 20676	Sampler Type	Andersen___ SAS x	SampleAire___ AeroTrap x	Other___ BioCulture___
Phone/Fax	3016438434	PO#/Job#/Project Name: EPA- Crystal City			
Email	cecilinc@comcast.net				
Routine ◉	24 Hour ○ Same Day ○ 4 Hour ○ 2 Hour ○	5 Day (Asbestos Only)	Notes/CC Info:		
Zip Code Where Work Is Performed	Washington, DC				

	Sample No.	Test Code	Sample Location	Total Volume/Area
1	080114-A1	MEA	see field notes	142L
2	080114-A2	1054		75L
3	080114-A3	MEA		142L
4	080114-A4	1054		75L
5	080114-A5	MEA	Outdoors	142L
6	080114-A6	1054	Outdoors	75L
7	080114-BLANK	MEA	blank	--
8	080114-BLANK	1054	blank	--
9				
10				
11				
12				
13				
14				

1054	Direct, Non-viable Spore Trap	1015	Culture - WATER Legionella
1051	Direct, Qualitative- **Swab/Tape**	1017	Culture - SWAB Legionella
1050	Direct, Qualitative- **Bulk**	1010	WATER - Potable - E. coli/total coliforms
1005	AIR Culture - Bacterial Count w/ ID's	1012	SWAB - E. coli/total coliforms
1030	AIR Culture - Fungal Count w/ ID's	1028	Sewage Screen (E. coli/Enterococcus/fecal coliforms)
1006	SWAB Culture - Bacterial Count w/ ID's	2056	Heterotrophic Plate Count
1031	SWAB Culture - Fungal Count w/ ID's	3001	ASBESTOS - Point count
1008	BULK Culture - Bacterial Count w/ ID's	3002	ASBESTOS - PLM Analysis
1033	BULK Culture - Fungal Count w/ ID's	3003	ASBESTOS - Particle characterization
1007	WATER Culture - Bacterial Count w/ID's	3004	ASBESTOS - PCM Analysis

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